20, 24-31, 33-34, 36-40 and new claims 41-71 are pending in the present application, of which claims 1-5, 52, 58 and 65 are independent.

Referring now to the Office Action, rejections are made as follows:

Claims 1, 2, 8, 13, 15, 17 and 19 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tang (U.S. Patent No. 5,684,365) in view of Kurosawa (U.S. Patent No. 6,057,647) and Hattori (U.S. Patent No. 5,889,459).

Claim 31 is rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa and Ogura (JP 07-014678A).

Claim 3 is rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa and Aisenberg (U.S. Patent No. 4,530,750).

Claims 4, 5, 38 and 40 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa, Ogura and Poppal (U.S. Patent No. 6,283,578).

Claims 7 and 32 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa and Hattori as applied to claims 1 and 2 above, and further in view of Kim (U.S. Patent No. 6,100,954).

Claims 9 and 14 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa and Hattori as applied to claims 1 and 2 above, and further in view of Shimoda et al. (SID 99 Digest, p. 376-379).

Claims 10 and 21 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa, Ogura and Poppal as applied to claims 4 and 5 above, and further in view of Kim (U.S. Patent No. 6,100,954).

Claim 16 is rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa and Aisenberg as applied to claim 3 above, and further in view of Shimoda et al.

Claims 18 and 20 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa, Ogura and Poppal as applied to claims 4 and 5 above, and further in view of Shimoda et al.

Claims 22 and 23 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa, Ogura and Poppal as applied to claim 5 above, and further in view of Nagao (JP 60-228821).

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Claims 30 and 33 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa and Hattori as applied to claims 1 and 2 above, and further in view of Kobayashi (U.S. Patent No. 5,680,185).

Claim 34 is rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa and Hattori as applied to claim 2 above, and further in view of Nagao.

Claim 35 is rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa and Aisenberg as applied to claim 3 above, and further in view of Kim.

Claim 36 is rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa and Aisenberg as applied to claim 3 above, and further in view of Kobayashi.

Claims 37 and 39 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tang in view of Kurosawa Ogura and Poppal as applied to claims 4 and 5 above, and further in view of Kobayashi.

All of the § 103(a) rejections summarized above are respectfully traversed at least for the reasons provided below.

Applicants have canceled claims 7, 10-12, 21-23, 32 and 35. Accordingly, the § 103 rejections of these claims are now moot.

The present invention is characterized by a method of manufacturing an electrical device, comprising the steps of, among other steps, forming a thin film transistor, forming a first insulating film comprising an organic material over the thin film transistor, forming a second insulating film on the first insulating film, forming an EL layer through an ink jet method.

As amended, all the independent claims include the feature of forming a first insulating film comprising an organic resin over a thin film transistor and forming a second insulating film comprising an inorganic material such as silicon nitride, aluminum nitride or aluminum oxide, or a DLC on the first insulating film.

The first insulating film comprising the organic material acts as a leveling film to level an upper surface of an active matrix substrate. As explained in the specification, the leveling of steps due to the thin film transistor by the second insulating film is extremely important. The EL layer formed afterward is very thin. There are cases in which poor luminescence is caused by the existence of a step (i.e. not leveled surface). Thus, it is preferable to perform leveling before forming a pixel electrode so as to be able to form the EL layer on as level of a surface as possible, as disclosed in page 18, lines 15-21 of the specification.

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However, it is a concern that some gases degas from the organic material in the leveling film which can badly affect the EL layer in such a way that the quality of the light emitting device would be decreased. In a case that the second insulating comprising a material, such as silicon nitride, aluminum nitride, aluminum oxide, and diamond like carbon, is formed on the organic leveling film, it is possible to avoid introducing the degassing gases into the EL layer.

In addition, the second insulating film can prevent alkaline metal from penetrating the thin film transistor from the EL element. In the EL element, there is included at least an electrode which comprises the alkaline metal, for example, lithium in a cathode, as disclosed in page 26, lines 19-28 of the specification.

Further, because the EL layer is formed by the ink jet method not in a vacuum but in an external atmosphere, it is disadvantageous in that contaminants in the external atmosphere are easily introduced into the EL layer. Namely, it is a problem in that EL layers are formed in a state that easily includes mobile ions, such as alkaline metals, diffusion of the alkaline metals, which can cause fatal damage to the thin film transistors, as disclosed, in page 2, lines 21-27 of the specification. In view of the aforementioned disadvantages and problems, a solution to these disadvantages and problems are addressed by the invention recited in Applicants' pending claims.

Applicants respectfully submit that none of the references cited discloses, teach, or suggest the specific feature of laminating the organic leveling film and the passivation insulating film. More specifically, none of the cited references disclose, teach, or suggest forming a first insulating film comprising an organic resin over the thin film transistor and forming a second insulating film on the first insulating film as recited in amended independent claims 1, 2, 3, 4, and 5.

With respect to Tang, Tang teaches an insulating layer, preferably silicon dioxide, 52 is formed over a thin film transistor. A transparent electrode material 72, preferably ITO, is formed to be in contact with the drain region of TFT 2. A passivating layer 74 of an insulating material, preferably silicon dioxide, is deposited over the surface of the device. The organic electroluminescent layer 82 is then deposited over the passivation layer and the EL anode layer. Then, the EL cathode 84 is deposited over the surface of the device , as disclosed in col. 7, line 14 through col. 10, line 22 of Tang.

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However, as disclosed in Tang, the insulating layer 52, the passivation layer 74 are formed of silicon dioxide. The Tang reference does not disclose the insulating film on the organic film. Therefore, it is not possible to obtain the effect mentioned above, in particular the prevention of degassing.

With respect to Kurosawa, an interlayer insulation film 52 is deposited on the selection transistor 2, the drive transistor 3 and the organic EL element 4 such that the upper surface of the film 52 is made flat, as disclosed with col. 5, lines 36-40 of Kurosawa. Applicants respectfully submit that it is not taught by Kurosawa what material the interlayer insulation film 52 is made from, in addition the lack of description of the insulating film on the film 52.

In view of the above arguments set forth with respect to Tang and Kurosawa, and as all the §103 rejections are based on the combination of references including Tang and Kurosawa, Applicants respectfully submit that the claimed device cannot be manufactured by the combined method by these references, and that the presently claimed invention distinguishes over Tang and Kurosawa.

With respect to Hattori, Hattori discloses that said metal oxide insulating film prevents not only the diffusion of alkali ions, which causes a decline in reliability in the case that the thickness of the film is reduced to enhance the resistance, but also the change in quality of said resistive film to moisture, as disclosed in col. 5, lines 33-40 of Hattori.

However, Hattori is not related to a light emitting device but to a metal oxide film resistor. In the present invention it is specified that the passivation insulating film prevents the alkali ions which come from the EL layer and the external atmosphere from contaminating in the thin film transistor. Therefore, it is not possible to realize the claimed device by combining Tang, Kurosawa and Hattori since there is no real suggestion to combine the teachings of Hattori with the other cited references because it relates to a different type of device.

With respect to Ogura, Ogura appears to teach an insulating silicon nitride film 2a which comprises Si_3N_4 for preventing diffusion of alkali ion from a glass substrate 1. Applicants respectfully submit that the up-and-down structure of Ogura is different from the claimed invention, and, thus, there is no real suggestion to combine its teachings with any of the other references.

With respect to Aisenberg et al., it is disclosed therein that a densely packed diamond-like carbon structure having packed grain boundaries and internal crystalline resistance to the

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motion of relatively large alkali ions, as disclosed in col. 9, lines 26-29 thereof. However, the Aisenberg's apparatus is for coating an optical fiber, and is not related to a method of manufacturing an EL display device.

Further, in the present invention, the diamond like carbon is advantageous for the present passivation film. Not only the diamond like carbon film acts as the passivation insulating film, but also as the heat radiation film. In the specification, it is described that the diamond like carbon films have very high thermal conductivity, and are extremely effective as radiation layers, as disclosed in page 16, lines 11-13.

With respect to Popple, Popple merely shows that nitrogen is passed through each head, as disclosed in col. 4, lines 29-30. Since the EL layer is easily deteriorated by the existence of water or oxygen, it is necessary to remove such a factor thoroughly when the layer is formed. For example, a dry nitrogen atmosphere, a dry argon atmosphere, or the like is preferable, as disclosed in page 26, lines 7-13. Applicants respectfully submit that there is no motivation to combine Popple with the other references, because the problem of the deterioration of the EL layer is noted in neither Popple nor the other cited prior art references.

With respect to Kim, Kim is related to a liquid crystal display device. In this liquid crystal display device, the organic protection layer 159 and the third inorganic film 181 thereon are formed, as disclosed in col. 19, lines 51-65. Although Kim discloses the inorganic film on the organic film, the reference teaches only the liquid crystal display device. Thus, the problems caused by the EL element, the organic film and the thin film transistor mentioned above would not occur in the Kim patent. That is, in Kim, it is not a concern that the degassing from the organic leveling film badly affect the EL layer, and that the alkali ions from the EL layer have the fatal influence to the active layer of the thin film transistor. Because Kim is related to the liquid crystal display device, it should not be proper to combine this patent with the other cited prior art references to overcome the problems indicated in the present application.

With respect to Shimoda, Applicants respectfully submit that Shimoda does not cure the above-mentioned deficiencies of Tang and Kurosawa, as well as of other cited references. Accordingly, Shimoda cannot be combined with Tang and Kurosawa and any other cited prior art references.

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With respect to Nagao, it is disclosed therein the rare earth elements in the thermal head. Applicants respectfully submit that there is no relationship between the teaching of Nagao and the EL display device of the claimed invention.

With respect to Kobayashi, although Kobayashi discloses the Al-Mg alloy film to form the pixel electrode 69, as disclosed in col. 17, lines 32-35 of Kobayashi, Kobayashi merely teaches an example of the pixel electrode in the polymer dispersed liquid crystal (PDLC) display apparatus, while the present invention is characterized in the method of manufacturing the light emitting device including the EL layer.

It should be clear from the detailed discussion above, that cited references are not properly combined under 35 U.S.C. 103 because they are not related to the same underlying technology, and, thus, there can be no suggestion to combine them with one another. The Examiner, instead, is engaging in piece meal reconstruction based on hindsight to satisfy the requirements of Section 103. In view of the foregoing amendments and arguments, Applicants respectfully request reconsideration and withdrawal of the U.S.C. § 103(a) rejections of claims 1-5, 7-23, 30-40.

New claims 41-71 have been added to further complete the scope of the present invention to which Applicants are entitled.

CONCLUSION

Having responded to all rejections set forth in the outstanding final Office Action, it is submitted that claims 1-5, 7-23, 30-40 and new claims 41-71 are now in condition for allowance. An early and favorable Notice of Allowance is respectfully solicited.

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In the event that the Examiner is of the opinion that a brief telephone or personal interview will facilitate allowance of one or more of the above claims, the Examiner is courteously requested to contact Applicants' undersigned representative.

Respectfully submitted,

By________________________
Luan C. Do
Reg. No. 38,434

NIXON PEABODY, LLP
8180 Greensboro Drive, Suite 800
McLean, Virginia 22102
Telephone: (703) 770-9300
Facsimile: (703) 770-9400

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VERSION OF AMENDED CLAIM WITH MARKINGS TO SHOW CHANGES MADE

1. (Twice Amended) A method for manufacturing an electrical device, said method comprising [the steps of]:

forming at least a thin film transistor on an insulating surface;

forming [an] a first insulating film comprising an organic resin over the thin film transistor;

forming a second insulating film comprising silicon nitride on the first insulating film;

forming a pixel electrode [over] on the second insulating film, said pixel electrode [being] electrically connected to the thin film transistor;

forming an EL layer over the pixel electrode;

forming a second electrode over the EL layer,

wherein the EL layer is selectively formed through an ink jet method,

[wherein the insulating film comprises silicon,]

wherein the insulating film is capable of preventing penetration of alkaline metal].

2. (Twice Amended) A method for manufacturing an electrical device, said method comprising [the steps of]:

forming at least a thin film transistor;

forming [an] a first insulating film comprising an organic resin over the thin film transistor;

forming a second insulating film comprising at least one selected from the group consisting of aluminum oxide, aluminum nitride and nitrated aluminum oxide on the first insulating film;

forming a pixel electrode over the second insulating film, said pixel electrode [being] electrically connected to the thin film transistor;

forming an EL layer over the pixel electrode;

forming a second electrode over the EL layer,

wherein the EL layer is selectively formed through an ink jet method[,]

[wherein the insulating film comprises aluminum oxide,]

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[wherein the insulating film is capable of preventing penetration of alkaline metal].

3. (Twice Amended) A method for manufacturing an electrical device, said method comprising [the steps of]:

forming at least a thin film transistor on an insulating surface;

forming [an] a first insulating film comprising an organic resin over the thin film transistor;

forming a second insulating film comprising diamond like carbon on the first insulating film;

forming a pixel electrode over the second insulating film, said pixel electrode [being] electrically connected to the thin film transistor;

forming a EL layer over the pixel electrode;

forming a second electrode over the EL layer;

wherein the EL layer is selectively formed through an ink jet method[,]

[wherein the insulating film comprises diamond like carbon,]

[wherein the insulating film is capable of preventing penetration of alkaline metal].

4. (Twice Amended) A method for manufacturing an electrical device, said method comprising [the steps of]:

forming at least a thin film transistor on an insulating surface;

forming [an] a first insulating film comprising silicon nitride over the thin film transistor;

forming a second insulating film comprising an organic resin on the first insulating film;

forming a third insulating film comprising silicon nitride on the second insulating film, wherein the third insulating film comprises the same material as the first insulating film;

forming a pixel electrode over the third insulating film, said pixel electrode [being] electrically connected to the thin film transistor;

forming an EL layer over the pixel electrode;

forming a second electrode over the EL layer,

wherein the EL layer is selectively formed through an ink jet method [in an atmosphere comprising nitrogen],

[wherein the insulating film is capable of preventing penetration of alkaline metal].

5. (Twice Amended) A method for manufacturing an electrical device comprising [the steps of]:

forming at least a thin film transistor on an insulating surface;

forming [an] a first insulating film comprising at least one selected from the group consisting of aluminum oxide, aluminum nitride and nitrated aluminum oxide over the thin film transistor;

forming a second insulating film comprising an organic resin on the first insulating film;

forming a third insulating film comprising at least the one selected from the group consisting of aluminum oxide, aluminum nitride and nitrated aluminum oxide on the second insulating film, wherein the third insulating film comprises the same material as the first insulating film;

forming a pixel electrode over the third insulating film, said pixel electrode [being] electrically connected to the thin film transistor;

forming an EL layer over the pixel electrode;

forming a second electrode over the EL layer,

wherein the EL layer is selectively formed through an ink jet method [in an atmosphere comprising argon],

[wherein the insulating film is capable of preventing penetration of alkaline metal].

31. (Amended) A method according to claim 1,

wherein the second insulating film comprises at least one selected from the group consisting of silicon nitride oxide and silicon nitride.

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38. (Amended) A method according to claim 4,

wherein [the atmosphere is] the EL layer is formed in a dry nitrogen atmosphere.

40. (Amended) A method according to claim 5,

wherein [the atmosphere is] the EL layer is formed in a dry argon atmosphere.

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